Dynamic Pull-in for Actuated Micro Cantilever Beam Made of Power-Law Materials

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Analysis for the dynamic pull-in occuring in the micro-electro-mechanical system with an actuated cantilever beam made of power-law materials is presented, see Fig 27.

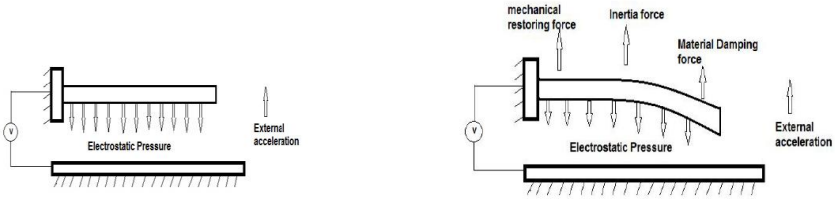

Fig. 27 MEMS with an actuated cantilever beam

The pull-in parameter describing the fundamental limit on the device travel range is derived using lumped model for the power-law cantilever beam, cf. [3]. The model differential equation contains a nonlinear power-law term describing the restoring force and a singular term corresponding to the nonlinear electrostatic Coulomb force, respectively. The pull-in threshold and pull-in time are estimated precisely in terms of model parameters. The presented analysis is supported by the results from [1] and [2]. The sufficient conditions for the existence of the periodic solutions to the lumped-model are proved analytically and verified numerically.

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[2] D. Omarov, D. Nurakhmetov, D. Wei, P. Skrzypacz. Accepted for the publication in Applied and Computational Mechanics
[3] D. Nurakhmetov, D. Wei, P. Skrzypacz. Preprint